

**A FINANCIAL MODEL TO ESTIMATE ANNUAL PAYMENTS REQUIRED
UNDER PERFORMANCE BASED CONTRACTS**

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ABSTRACT

Over the last couple of decades there has been an increased interest by road agencies to adopt performance based contracts (PBC) for road maintenance as a means to increase the efficiency of maintenance operations. PBC is a type of contract in which payments for the management and maintenance of road assets are explicitly linked to the contractor successfully meeting or exceeding certain clearly defined minimum performance indicators.

This paper presents the development of a user-friendly tool for estimating the annual payments by the government that will be required by potential contractors to undertake a PBC project. The model is expected to be useful to both the public and the private sectors. For example, a road agency planning to launch a PBC program will need to make an estimate of the annual payments that the agency will have to make to the private contractors. Conversely, private contractors interested in competing for the PBC program will have to make an estimate of the annual payments to include in their bids.

The applicability of the tool is demonstrated through a numerical example of a potential road PBC project. The model can also be applied to other types of transport infrastructure, such as a railway or waterway. The model can be used to carry out sensitivity analyses. For example, the user can change the value of an input parameter (e.g., construction cost) and obtain the resulting impact on the project financial internal rate of return, or other key model output.

INTRODUCTION

Performance-based contracts (PBC) differ significantly from method-based contracts that have been traditionally used to maintain transport infrastructure. PBC is a type of contract in which payments for the management and maintenance of an asset are explicitly linked to the contractor successfully meeting or exceeding certain clearly defined minimum performance indicators (1).

In traditional method-based contracts, the government agency, as the client normally specifies techniques, technologies, materials and quantities of materials to be used, together with the time period during which the maintenance works should be executed. The payment to the contractor is based on the amount of inputs (e.g., cubic meters of asphalt concrete, number of working hours). In performance-based contracting the client does not specify any method or material requirements (provided the country's standards are met). Instead the client specifies performance indicators (or levels of service) that the contractor is required to meet when delivering maintenance services.

According to the World Bank Procurement Guidelines (2), Performance Based Procurement, also called Output-Based Procurement, refers to competitive procurement processes resulting in a contractual relationship where payments are made for measured outputs instead of the traditional way where inputs are measured. The technical specifications define the desired result and which outputs will be measured including how they will be measured.

Over the last couple of decades there has been an increased interest by road agencies to adopt PBC for road maintenance as a means to increase the efficiency of maintenance operations. The overall perception is that PBC provide cost savings compared to other maintenance procurement methods, enable a greater transfer of risks from the agency, and promote innovation within the industry, ultimately leading to improved maintenance level of service (3).

Performance based contracts may have different forms and include activities like routine and/or periodic maintenance (4). Routine maintenance occur every year and comprise works on cleaning and maintenance of pavements, structures, signalization, and drainage, vegetation control, as well as winter maintenance. Periodic maintenance includes road resurfacing, road and bridge rehabilitation and reconstruction.

This paper focuses on the development of a user-friendly tool for estimating the annual payments by the government that will be required by potential contractors to undertake a PBC project. The model is expected to be useful to both the public and the private sectors, and particularly suitable for preliminary financial assessment of potential PBC projects.

DEVELOPMENT OF A GRAPHICAL FINANCIAL MODEL FOR PBC

The World Bank, supported by the Public-Private Infrastructure Advisory Facility (PPIAF), has developed a Toolkit for Public-Private Partnership (PPP) in Roads and Highways (the Toolkit) to assist policy makers in implementing procedures to promote private sector participation and financing in roads (5). The Toolkit includes Financial Models (in graphical and numerical

format) that can be used for the financial assessment of PPP toll roads. Based on the Toolkit toll road graphical financial model, a model was developed to assess the required annual payments under Performance Based Contracts (PBC). While the original model was developed for a toll road project, the PBC model can be applied to any transport infrastructure subsector (e.g., roads, rail, airports, and waterways). A previous adaptation of the original Toolkit graphical financial model led to the development of a tool to assess the financial feasibility of availability payment PPP projects (6).

Table 1 includes the abbreviations used in the model with usual range of values.

TABLE 1 Abbreviations used in the model

Abbreviation	Full name	Usual Range
NPV	Net Present Value	>0
DRr	Discount Rate in Real Terms	4% - 8%
DRn	Discount Rate in Nominal Terms	6% - 12%
ADSCR	Annual Debt Service Coverage Ratio	>1.10
LLCR	Loan Life Coverage Ratio	>1.10
PLCR	Project Life Coverage Ratio	>1.70
CBDS _i	Net Cash Flow before Debt Service in year i	n.a.
DS _i	Debt Service to be Paid in year i (Principal and Interests)	n.a.
IRR (FIRR)	(Financial) Internal Rate of Return	6% - 20%
ROE	Return on Equity (Equity Internal Rate of Return)	8% - 25%

As in the original model, the PBC financial model comprises five worksheets (Data Sheet, Cash Flow Graph, Debt Graph, Dividend Graph, and Summary of Assumptions and Results), the main functions and outputs of which are described in the next sections. Default values are provided for each parameter defining a hypothetical PBC project. The user can change the parameter values using the arrow keys (scroll bars) provided in the Data Sheet and graph sheets, so as to define the project to be financially assessed.

The Data Sheet (Figure 1) summarizes the main characteristics (assumptions) of the PBC project. A few assumptions, identified by arrow keys, can be changed using this sheet. The other key characteristics can be changed directly from the graph sheets.

Two types of loan repayment (annual reimbursements) are incorporated in the model:

- P+I constant: A constant amount (including Reimbursement of Capital and Interest) is paid each year
- Linear: The same amount of capital is reimbursed each year. The interest is calculated from the non-reimbursed capital.

Duration of works can vary from 1 to 3 years. The user enters the duration of works and the default values for distribution of works are displayed. The user can modify the default values by using the scrolling bars. The percentage of the first year is calculated as: 100% - sum (% year 2 and % year 3).

Graphical Model for Financial Simulation of Performance Based Contracts			
Summary of project assumptions			
Source of funds		Rehabilitation costs (VAT excluded, indexed on inflation)	
Subsidies	0%	Duration of works (years)	1 years
Equity	25%	Year	% Amount (MUSD)
Credit	75%	1	100% 20
Nominal interest rate	7.0%		0% 0%
Debt maturity	6 years		0% 0%
Grace period	1 years		0% 0%
Capitalization	1 years		0% 0%
Repayment of loan	P+I constant		
		Total in MUSD	20.00
		Amortization	6 years
Annual Payments		Annual maintenance costs (indexed on inflation)	
First year Payment	7.7 MUSD	Amount in opening year	1,000 kUSD per year
Payment growth	0% per year		
		Economic	
		Inflation rate	4.0%
		Corporate tax rate	20.0%
		VAT rate	15.0%
		State discount rate (real terms)	6.0%
		(nominal terms)	10.24%

FIGURE 1 Data sheet.

The capitalized items are assumed to be depreciated on a straight line basis throughout the Amortization period. The Amortization period is equal to, or less than, the difference between the contract life and the rehabilitation period.

The Operation costs include all annual operating and maintenance costs that are incurred during the operation period (i.e., from completion of the rehabilitation period until the end of the contract period). The Operation costs are expressed in terms of the annual equivalent amount of all operation, maintenance and rehabilitation costs during the operation period. The operation costs are inflation-adjusted (so their real values are kept constant).

State discount rate is the rate used to calculate the net present value (NPV) of government cash flows. The user should input the state discount rate in real terms (DR_r). The model then computes the state discount rate in nominal terms (DR_n) through the formula:

$$DR_n = DR_r + \text{Inflation} + DR_r \cdot \frac{\text{Inflation}}{100}$$

The Cash Flow Graph (Figure 2) represents all the contractor cash flows during the contract period. They are classified by order of repayment priority: Maintenance costs > Taxes > Debt service > Dividends > Shareholders account.

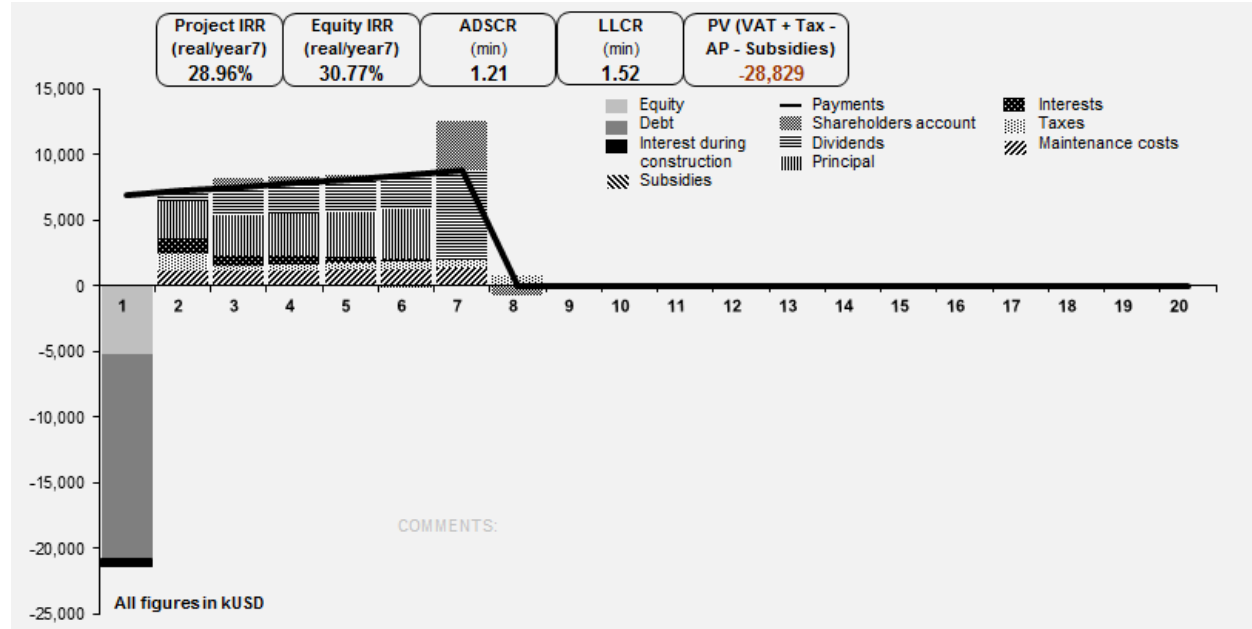


FIGURE 2 Cash-flow graph.

The shareholder account represents a bank account controlled by the company shareholders (fiscal restrictions generally limit the authorized distribution of dividends to the project net income) to which the cash balance is transferred (or drawn from if negative) until it can be distributed as dividends.

When the shareholders' account is insufficient to service the debt, shareholders have to fill the gap and this appears in the graph in the form of negative dividends.

The Debt Graph (Figure 3) represents, *for up to 20 years of the contract period*, separately on the left and right vertical axes, respectively:

1. Annual payment of principal and interest during the debt servicing period (grace period + repayment period)
2. The two main bank ratios over the repayment period: Annual Debt Service Coverage Ratio (ADSCR) and Loan Life Coverage Ratio (LLCR).

The ADSCR represents, for any operating year, the ability for the project company to cover/repay the debt taking into account the assumptions made in the model. This ratio is determined as follows:

$$ADSCR_i = \frac{CBDS_i}{DS_i}$$

where:

CBDS_i is the net cash flow before debt service in year *i* (i.e., the amount of cash remaining in the project company after operating costs and taxes have been paid), and
DS_i is the debt service to be paid in year *i* (principal and interests).

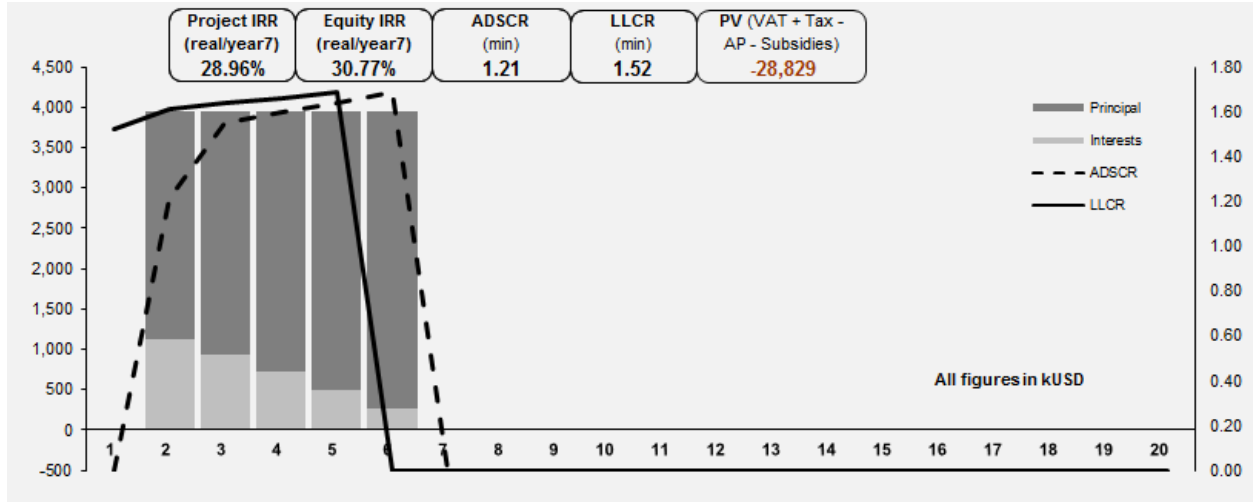


FIGURE 3 Debt graph.

The project is considered viable for the lenders when the ADSCR is greater than 1 plus a margin. If a margin of say 20% is deemed appropriate, then the ADSCR should be at least 1.20, for every year of the project life. This means that if, for whatever reason, the project revenue is 20% below what has been forecast in the financial model for a given year, the project company should still be able to repay the debt in that year. In high risk circumstances, a minimum ADSCR of 1.4 or higher is sometimes used. In the case of PBC, such risk is relatively low, as the Annual Payments, normally made through monthly installments, are government contractual obligations.

The LLCR indicates, for any one operating year, the capacity for the project company to bear an occasional shortfall of cash due to discrepancies in the assumptions in the model while maintaining its debt service to the end of the debt. This ratio is calculated as follows:

$$LLCR_i = \frac{NPV(CBDS_i \rightarrow \text{end})}{DS_i \rightarrow \text{end}}$$

where:

NPV (CBDS_i→end) is the present value of the net cash flow before debt service from year *i* to the end of the debt repayment period, and

DS_i→end is the total of debt service remaining at year *i* (principal and interests).

The project is considered viable for the lenders when the LLCR is high than 1 (plus a margin) for every year of the project life. The ADSCR and LLCR are used by the lenders to check the project capacity to repay debt in adverse scenarios, including if revenues are below forecasted levels. Nominal interest rate is used to calculate the annual interest paid.

The Dividend Graph (Figure 4) displays, for up to 20 years of the contract period, respectively on the left and right vertical axes:

1. The equity mobilized by company shareholders during the construction period and the dividends received by them during the operation period.
2. The two main financial indicators over the contract: the financial Internal Rate of Return of the project (Project IRR) and the Equity IRR.

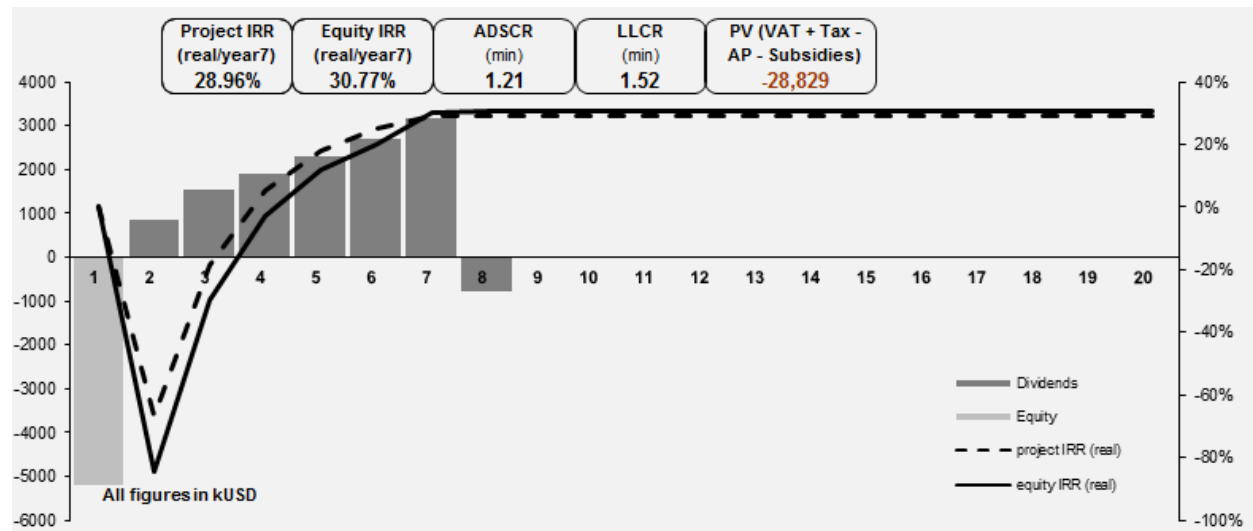


FIGURE 4 Dividend Graph.

The model allows a rapid verification that Project IRR is independent from the project financial structure (i.e., the proportion of subsidies, equity, and loan) while Equity IRR is directly related to it.

The assumptions and results of the project financial assessment are summarized on the **Summary of Assumptions and Results** sheet, presented in Figure 5.

Each one of the three graphs in Figures 2 to 4 displays five key project indicators / ratios (Figure 6):

- Project IRR – the project financial Internal Rate of Return for the contract period (in real terms)
- ROE – the Return on Equity for the contract period (in real terms)
- Minimum LLCR - the minimum Loan Life Coverage Ratio
- Minimum ADSCR - the minimum Annual Debt Service Coverage Ratio
- PV of net financial contribution from government. The government pays the required annual amounts to the contractor and recovers corporate taxes and VAT during the contract period. The indicator shows the present value for the government throughout the contract period. In the case of PBC, PV should in general be negative. The tax amounts (corporate tax and VAT) are positive (for this purpose), but they would in general be much smaller than the annual payments made to the contractor by the government.

Summary of Assumptions and Results

SUMMARY OF THE MAIN ASSUMPTIONS

GENERAL			ANNUAL PAYMENT		
Contract life	7	years	First year Payment	7700	kUSD
Rehabilitation Period	1	years	Payment growth	0.0%	per year
Rehabilitation costs	20,000	kUSD			
Amortization	6	years			
FINANCIAL STRUCTURE			ANNUAL MAINTENANCE COSTS		
Subsidy	0%	of the rehabilitation costs	Amount in opening year	1,000	kUSD per year
Equity	25%	of the rehabilitation costs			
Debt			OTHER KEY PARAMETERS		
Maturity	6	years	Inflation rate	4.0%	
Interest rate	7.0%		Corporate tax	20.0%	
Grace period	1	years	VAT rate	15.0%	
Repayment of loan	P+I constant				

SUMMARY OF THE RESULTS

FINANCING PLAN			FINANCIAL RATIOS		
Uses (in kUSD)	21,346		Minimum ADSCR (Annual Debt Service Coverage Ratio)	1.21	
Rehabilitation costs (nominal terms)	20,800		Minimum LLCR (Loan Life Coverage Ratio)	1.52	
Capitalised Interests	546		Minimum PLCR (Project Life Coverage Ratio)	1.77	
Sources (in kUSD)			SHAREHOLDERS' RETURN		
Investment subsidy	0		Project IRR after tax (real terms)	28.96%	
Equity	5,200		Project IRR after tax (nominal terms)	34.12%	
Debt	16,146		Equity IRR (real terms)	30.77%	
			Equity IRR (nominal terms)	36.00%	
PUBLIC AUTHORITIES' FINANCIAL FLOWS					
PV on Availability Payments (kUSD)	-37,378				
PV on Subsidy (kUSD)	0				
PV on the VAT (kUSD)	5,607				
PV on the Corporate Taxes (kUSD)	2,942				
PV on the State revenues (kUSD)	-28,829				

FIGURE 5 Summary of Assumptions and Results.

Project IRR (real/year7)	Equity IRR (real/year7)	ADSCR (min)	LLCR (min)	PV (VAT + Tax - AP - Subsidies)
28.96%	30.77%	1.21	1.52	-28,829

FIGURE 6 Project indicators / ratios.

Thirteen key project characteristics (Figure 7) can be modified in any of the three graphs. Following any change in parameters, all the worksheets are automatically updated. The ranges of variables included in the model reflect realistic conditions in most projects. When required, such ranges can be changed by model specialists.

Contract life	Rehabil. cost	Maintenan. Cost	Initial Payment	Payment Growth	Investment Subsidies	Equity	Debt maturity	Interest Rate	Grace Period	Inflation rate	Corporate tax rate	VAT rate
7	20,000	1,000	7,700	0.0%	0%	25%	6	7.0%	1	4.0%	20.0%	15.0%

FIGURE 7 Key project characteristics.

Comments are triggered by the model to inform of unrealistic or impossible data entries. For example, if the concession life is set at a value less than the debt maturity, a message is displayed to alert the user and the model automatically corrects the debt maturity to ensure consistency. Comments are also provided if results deemed unfeasible are obtained (e.g., ADSCR less than 1.1).

NUMERICAL EXAMPLE

Let us assume that a road agency wants to award a 7-year performance-based contract for rehabilitating a given road section in year 1 and maintain the road to comply to specified performance indicators in the subsequent years of the contract. This numerical example will illustrate how the PBC financial model can be used to estimate the minimum Annual Payment that a potential PBC contractor will require from the road agency to undertake the proposed contract. We will assume that a study of the prevailing road and traffic conditions, as well as economic data in the country, indicated that the following data apply to the proposed PBC contract:

Contract life: 7 years

Rehabilitation cost in the first year of the contract: US\$20 million

Annual maintenance cost in subsequent years of the contract: \$1 million per year (at opening year)

Capital structure: Equity, 25%; Loans, 75%

Nominal interest rate: 7% per year

Loan grace period: 1 year

Loan repayment period: 6 years

Discount rate (real terms): 6%

Inflation: 4% per year

Tax rates: (a) VAT: 15%; (b) Corporate tax: 20%

Amortization period: 6 years

Let us also assume that the following targets (or constraints) will have to be met for the project to be able to attract private investors:

Project Financial Internal Rate of Return: $FIRR \geq 8\%$

Equity Internal Rate of Return (or Return on Equity): $ROE \geq 14\%$

Annual Debt Service Cover Ratio: $ADSCR \geq 1.2$

The model can now be used to estimate the minimum Annual Payment that a potential contractor will require from the government to undertake the project. As a first step, the user should enter the data provided using both the Data and the Cash Flow Graph worksheets. Assuming there are no revenues to the contractor other than the Annual Payment, the “Initial Payment” in the Cash Flow Graph will be the Annual Payment required by the contractor.

The user can now go to the Cash Flow Graph and obtain the minimum Annual Payment (\$ million) by trial and error, by varying the Initial Revenue so that the financial indicators

calculated by the model are equal to, or just above the minimum required threshold given above for the three indicators considered critical for the project: FIRR, ROE, and ADSCR. By doing this, the user should find that an Initial Annual Payment of \$7.7 million is the minimum amount that would satisfy the three indicators.

In conclusion, an Annual Payment of \$7.7 million (in the first year of operation; payments in subsequent years would be adjusted according to inflation) should be able to attract private contractors. The corresponding three financial indicators are FIRR = 28.96%, ROE = 30.77%, and ADSCR = 1.21.

The model can also be used to carry out sensitivity analyses. The user can change the value of an input parameter (e.g., rehabilitation cost) and obtain the resulting impact, for example, on the project financial internal rate of return.

SUMMARY AND CONCLUSIONS

Performance based contracts for road maintenance have been increasingly used by road agencies over the last couple of decades as a means to increase efficiency of maintenance operations.

The paper presented the development of a user-friendly model to assess the required annual payments under Performance Based Contracts (PBC). The tool is based on the graphical financial model of the Toolkit for Public Private Partnership in Roads and Highways, which was developed by the World Bank, supported by the PPIAF.

The applicability of the tool has been demonstrated through a numerical example of a potential road PBC project. The model can also be applied to any other type of infrastructure.

The model can be used to carry out sensitivity analyses. The user can change the value of an input parameter (e.g., construction cost) and obtain the resulting impact, for example, on the project financial internal rate of return. Such a simplified model is particularly useful when only preliminary project data is available.

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